June 21, 1966 A. J. HUNT 3,256,808

SCREW PRESS EXTRACTOR

Filed June 1, 1964

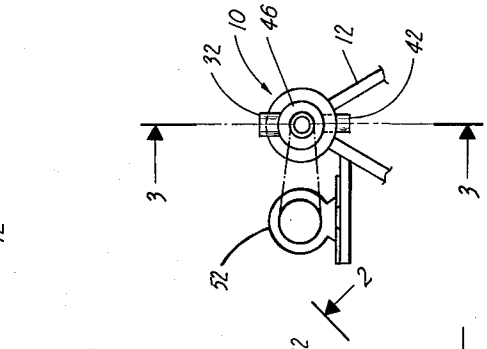


FIG. 2

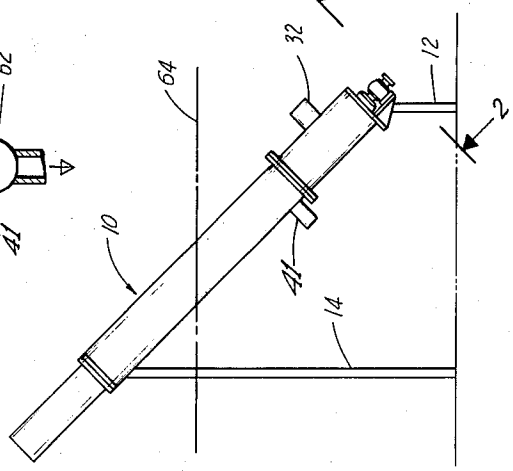


FIG. 1

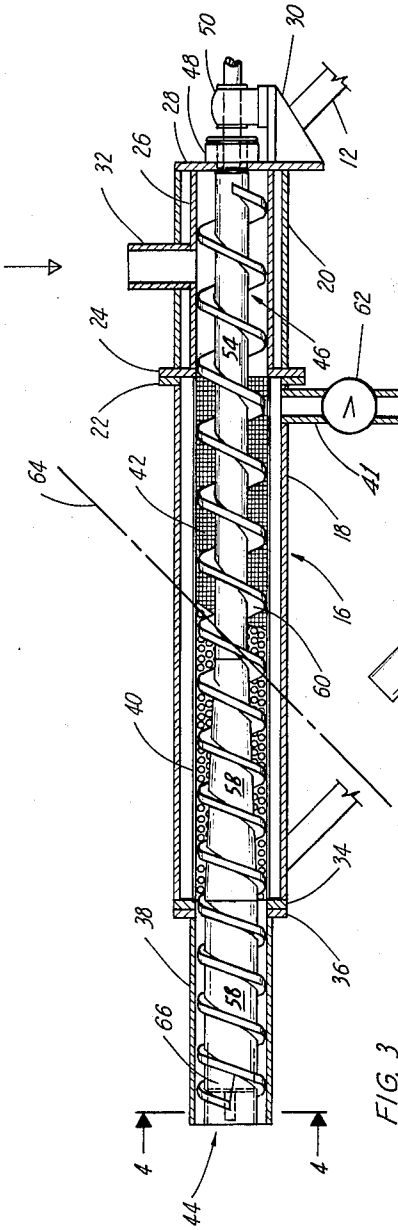


FIG. 3

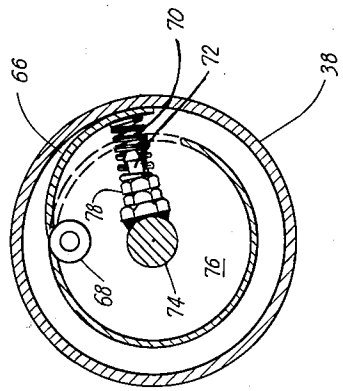


FIG. 4

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SCREW PRESS EXTRACTOR

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6 Claims. (Cl. 100—117)

This application is a continuation-in-part of my copending application Serial No. 285,109 filed June 3, 1963, now Patent No. 3,135,193.

This invention relates to screw press extractors and more particularly to a novel and improved screw press particularly adapted for use in extracting liquid from a slurry of wood pulp and liquid in a continuous-flow pulping process.

In the processing of wood chips to pulp, the chips are placed in a digester which is a large vessel containing a solution referred to as cooking liquor. The pulp and cooking liquor are then heated under pressure in order to remove resins and gums from the chips and to dissolve the lignin which holds together the desired cellulose fibers in the wood. In one process of digesting pulp, a batch method is used wherein the digester is a relatively large vessel, and wherein after a predetermined length of cooking time, the contents of the digester are discharged into another vessel at atmospheric pressure, this latter step being referred to as blowing. In another process, referred to as a continuous-flow digester system, the chips are continuously passed through a digester containing cooking liquor and under a steam pressure of at least 150 to 175 p.s.i. In either method of digesting wood pulp, it is important to preserve the cooking liquor inasmuch as it is relatively expensive and may be reused after suitable processing. In the continuous-flow method, the vessel receiving the continuous discharge of pulp and liquor and/or the means for conveying the wet pulp to a second vessel for washing must be such that it will not result in a substantial bleeding of pressure from the digester as this would adversely affect the economics of the cooking cycle.

The pulp as it is discharged from either a batch or continuous-flow digester contains up to 96 to 97 percent, by weight, of cooking liquor. As previously noted it is important to recover the liquor for reuse, and further, it it necessary to remove the same from the pulp prior to subsequent operations in the manufacture of paper. This may be accomplished by passing the saturated pulp through rollers, whereby the pulp is compressed to remove at least a portion of the liquor therefrom. In pressing the pulp it is important that it be compressed sufficiently to remove the maximum amount of liquor therefrom without compressing it sufficiently to crush the cellulose fibers together to form paper; for example, the pulp might be pressed until it had approximately 25 percent, by weight, of liquid remaining therein.

This invention contemplates using a screw press for effecting the above described extracting step. Such a screw press might comprise an elongated, rotatable worm or screw fitting within a foraminate sleeve which in turn is contained within a housing forming means for collecting liquid passing through the screen. Liquid tends to pass through the screen while solids are carried longitudinally of the screen by the rotating screw. The cross-sectional area of the passageway or channel defined by the screw thread or rib diminishes from the inlet end of the screen toward the outlet end thereof whereby the solids collected are compacted or compressed to extract liquid contained therein, with the liquid passing through the screen and into the collection means formed by the housing. Where, among other reasons, the solids being separated have a characteristic of tending to adhere to adjacent surfaces, there may be a tendency of the solids

to clog the screen and prevent efficient flow of liquid therethrough. This is true where a slurry of liquid and wood pulp is being passed through the extractor.

Accordingly it is one of the primary objects of this invention to provide a novel and improved extractor of the screw press type for separating liquids and solids from a slurry thereof, or from solids containing a relatively large percentage of liquid, and which will substantially eliminate any tendency of the screen to clog with solids so as to impair significantly the flow of liquid from the extractor.

It is a further object of this invention to provide a novel and improved extractor of the type described which is particularly adapted for extracting liquid from wood pulp and which will provide a satisfactory reduction in liquid content of the pulp without compacting the same sufficiently to form paper or otherwise adversely affect subsequent operation on the pulp.

Included within the last mentioned object, is the object of providing such an extractor which is particularly adapted for use in combination with a continuous-flow digester, whereby the extractor may be connected to receive pulp directly from the digester without causing a significant bleed of pressure from the digester.

In accordance with one aspect of the invention a screw press is provided which is adapted to receive material at an inlet pressure of, for example, up to at least 150 p.s.i., which will extract liquid from the solids contained within the material and discharge the liquid at a pressure not substantially less than the inlet liquid pressure while at the same time will discharge the solids to atmospheric presure. The extractor comprises an elongated screw fitting closely within a series of cylindrical members including a pair of imperforate cylindrical members at either end of the screw. A foraminate cylindrical member is disposed intermediate the ends of the screw and is contained within a housing forming means for collecting liquid extracted from the material being processed. The extractor extends at a substantial angle to the horizontal and has an inlet opening disposed between the ends of the imperforate cylindrical member at the inlet end of the screw and an outlet in said housing registering with a point intermediate the ends of said screen. The screw and cylindrical members cooperate to form a helical passage extending longitudinally of the screw axis. The cross-sectional area of this passage decreases very gradually from the inlet end of the screw to the outlet end thereof. A valve is provided in the outlet passage to maintain the pressure drop across the extractor sufficiently small that there will not be a significant adverse bleed of pressure from the pressure vessel from which the material is being fed to the inlet of the extractor. Also, this valve, as well as the speed of rotation of the screw, controls the outlet flow of liquid, so that the liquid level within the extractor is maintained substantially above the outlet, with the result that the solids are maintained in a liquid over a substantial portion of the screen length. This prevents the solids from clogging the screen below the liquid level in the extractor and particularly adjacent the liquid outlet. The screw carries solids above the liquid level in the extractor toward the outlet end, wherein is provided means for tending to obstruct the flow of solids from the outlet end of the helical passage through the extractor. Such obstruction means are adjustable to provide a predetermined back pressure at the outlet end of the extractor, whereby solids will build up for a substantial length from the outlet end of the extractor toward the inlet end thereof forming a relatively solid pack of material preventing the escape of pressure from this end of the extractor and in another aspect of the invention acting as a journal or bushing for the outer end of the screw.

The novel features which are believed to be characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing, in which:

FIG. 1 is a side elevational view of an extractor incorporating the present invention with parts removed for clarity;

FIG. 2 is an end view of the extractor of FIG. 1, as indicated by the line 2—2 of FIG. 1;

FIG. 3 is an enlarged, longitudinal cross-sectional view of the extractor substantially along line 3—3 of FIG. 2; and

FIG. 4 is an enlarged, cross-sectional view substantially along the line 4—4 of FIG. 3.

With reference to the drawing, and particularly FIGS. 1–3 thereof, an extractor incorporating the present invention is generally indicated at **10**. As shown in FIG. 1 the extractor extends at a substantial angle to the horizontal, being supported by frames or standards **12** and **14** adjacent the inlet and outlet ends, respectively, of the extractor. As most clearly shown in FIG. 3, the extractor comprises the housing, generally indicated at **16**, including a pair of coaxially disposed cylindrical, imperforate members **18** and **20**. The cylindrical members **18** and **20** have flanges **22** and **24**, respectively, at their next adjacent ends which are joined in fluid tight relation. Disposed concentrically within the cylindrical member **20** is a cylindrical, imperforate member **26** which is spaced radially inwardly from the member **20** and is joined in fluid tight relation at one end to the flange **24**. The ends of the cylinders **20** and **26** opposite the flange **24** are closed by an end plate **28** on which is mounted a bracket **30** to which the standard **12** is connected. An inlet conduit **32** extends radially outwardly from the cylinder **26** intermediate the ends of the cylinder and through the cylinder **20** for connection to a source of material to be fed into the extractor.

The end of the cylinder **18** opposite the flange **22** terminates in a radially inwardly extending flange **34** which is secured in fluid tight relation with a radially outwardly extending flange **36** at one end of a cylindrical imperforate member **38** extending coaxially of the cylinder **18**. It will thus be seen that the housing is provided with an elongate, cylindrical bore having a central portion formed by the cylinder **18** and a pair of reduced diameter portions at either end of the central portion formed by the cylinders **26** and **38**.

Disposed within the central portion of the housing is a foraminate, cylindrical sleeve **40** extending coaxially of and disposed within the cylinder **18** in radially inwardly spaced relation. The sleeve **40** is fixed relative to the cylinder **18**, such as by welding the ends of the sleeve to the flanges **22** and **34**. Disposed within and lining the sleeve **40** is a generally cylindrical screen **42** which has an inner surface generally providing a continuation of the cylindrical surfaces of the cylinders **26** and **38** which have equal inner diameters. The screen **42** has openings substantially smaller than those of the sleeve **40** with the screen **42** providing control of the size of the solids which may pass through the sleeve **40** into the liquid collection space between the sleeve and cylinder **18**. The screen **42** is relatively flexible while the sleeve **40** is relatively rigid so as to provide support for the screen during operation of the apparatus. A liquid outlet conduit **41** is provided which communicates at its inner end with the space between the cylinder **18** and sleeve **40** and is located between the ends of the cylinder **18** more closely adjacent the flange **22** than the flange **34**.

Disposed concentrically within the substantially constant diameter, cylindrical passage formed by the cylinders **26** and **38** and the screen **42** is a screw, generally indicated at **44**. The screw comprises a shaft or shank, generally indicated at **46**, and extending coaxially of the housing. The inlet end of the shaft extends outwardly through a rotating seal **48** carried by the end plate **28** and through a bearing **50** carried by the bracket **30**. The outer end of the shaft, as is shown in FIG. 2, is drivingly connected, such as by belt or chain and sprocket drive, to an electric motor **52** supported by the standard **12**.

The screw shank **46** comprises a first portion **54** extending from next adjacent the end plate **28** to a point intermediate the ends of the screen **42** whereat it terminates in a reversely-tapered, frusto-conical second portion **56**. The portion **56** of the shank terminates adjacent the flange **34** in a cylindrical third portion **58**. All portions of the shaft are spaced radially inwardly from the inner diameter of the surrounding cylindrical members. The screw further comprises a helical rib **60** extending from next adjacent the inlet end of the screw to the next adjacent the outlet end thereof. The outer diameter of the screw is substantially constant over the entire length of the rib **60**, and the rib outer diameter is disposed closely adjacent, if not engaged with, the inner surfaces of the next adjacent surrounding cylindrical members.

From a consideration of FIG. 3 it will be observed that the screw in cooperation with the next adjacent surrounding cylindrical members forms a helical passage extending from the inlet end of the screw to the outlet end thereof. It will also be observed that the cross-sectional area of this passage diminishes over the screw length from the inlet end toward the outlet end. This reduction in cross-sectional area of the passage is accomplished both by a decrease in the pitch of the rib **60** from the inlet to the outlet end of the screw, as well as by an increase in the outer diameter of the shank **46** of the screw over the frusto-conical portion **56** thereof. Where the extractor is used in connection with the removal of liquid from wood pulp the reduction in cross-sectional area of the helical passage should be relatively small, on the order of four to one, between the inlet and outlet end of the helical passage, and on the order of about three to one between the inlet end of the helical passage and the greater diameter end of the frusto-conical portion **56** of the shank. Also the pitch change of the rib should be quite gradual and the total decrease in pitch over the length of the screw relatively small. For example, in a practical design of the invention intended to be used for extracting liquid from wood pulp, and wherein the screw had an outer diameter of 4 inches and a length of about 5 feet the pitch at the inlet end of the screw was approximately 4 inches, while the pitch at the outlet end of the screw was approximately 3 inches. In this design, the frusto-conical portion **56** of the shank was approximately 1¼ feet long and had a lesser diameter at one end of about 2 inches and a greater diameter at the other end of about 3¼ inches whereby providing an included angle of approximately 9 degrees. The pitch of the rib decreased only slightly between the inlet end of the screen **42** and the lesser diameter of the frusto-conical portion **56**. Thereafter the pitch decreased from about 3¾ inches to slightly less than 3 inches at the outlet end of the screen which is approximately at the greater diameter end of the frusto-conical portion **56** of the shank. Thus, it can be seen that the cross-sectional area of the channel decreased very gradually. The rib extended about 16 turns with the greatest rate of change in cross-sectional area of the helical passage occurring over the frusto-conical portion **56** of the screw shank. In this area the channel cross-sectional area decreased in the ratio of about 3 to 1, or slightly less, and from the greater diameter of the frusto-conical portion to the outlet end of the screw decreased on the order of 1.25:1.

In using the apparatus of this invention to remove liquid from material fed directly from a vessel under pressure, such as a continuous-flow wood pulp digester, the inlet conduit **32** is connected to the vessel. A valve

62 is provided in the liquid outlet conduit 41 to maintain a small pressure drop across the extractor sufficient to permit the flow of liquid therethrough but insufficient to adversely bleed pressure from the vessel supplying the inlet 32. The material supplied may be in the form of a slurry comprising liquid and pulp containing a high percentage of liquid, for example, on the order of 97 percent by weight of liquid. The mixture is fed into the chamber defined by the cylindrical member 26 and rotation of the screw tends to feed the solids in the mixture toward the outlet end of the screw. The liquid in the extractor will extend vertically to a level, generally indicated in FIGS. 1 and 3 at 64, substantially above the outlet 41. The maintenance of the liquid level substantially above the liquid outlet 41 assures that the solids in the extractor below this point will be relatively free and uncompacted and will not clog the screen 42. The imperforate cylindrical member 26 prevents any flow of liquid outwardly from the inlet end of the extractor housing and assures that solids at the inlet end are submerged in liquid. Rotation of the screw keeps the solids in suspension in the liquid and prevents the solids from settling to the lower end of the extractor, thus preventing clogging of the inlet conduit. The solids will be collected on the rib 60 and carried above the liquid level 64 where they will be compressed in the area of the extractor corresponding to the frusto-conical portion of the shank to remove liquid therefrom. The extracted liquid will flow through the screen 42 into the space between the sleeve 40 and cylinder 18 and thence to the outlet 41. The solids pass from the greater diameter end of the frusto-conical shank 56 into the channel defined in part by the cylinder 38 where they are further compacted but to a lesser degree.

The discharge of solids from the outlet end of the passage formed in part by the screw is impeded by means at the discharge end of the channel in a manner to cause the solids to be relatively firmly packed to form a plug extending from the outlet end of the helical passage toward the inlet end of the screw and substantially to the inlet end of the cylinder 38. This plug of material serves to seal the outlet end of the apparatus to prevent the escape of pressure therefrom. Also this plug acts as a journal or bushing for the outer end of the screw shank, which it will be noted is otherwise unsupported except as provided by any contact between the outer diameter of the rib and the inner diameter of the cylinder 38.

In the specific embodiment shown, the means for obstructing the flow of solids from the outlet end of the screw comprises a member or flipper 66 which, as shown in FIG. 3, is disposed between the last and the next to last turn of the screw rib 60. The flipper 66 fits closely within an opening in the screw shank and has a leading edge remote from the outlet end of the screw passage. The leading edge of the flipper has an outer surface forming a continuation of the next adjacent outer surface of the screw shank. The leading edge portion of the flipper is, as is shown in FIG. 4, pivotally mounted as at 68 on the screw shank for movement of the other or trailing edge of the flipper outwardly and inwardly of the shank. In the specific embodiment shown, means are provided for resiliently and yieldably urging the flipper outwardly of the shank. Such means comprises a compression coil spring 70 telescopically disposed at one end over a post 72 fixedly mounted on a stub shaft 74 carried by a disc 76 disposed concentrically within and fixed to the tubular outer end of the screw shank 46. The post 72 extends radially of the shaft 74 which is disposed coaxially of the screw shank. A pair of nuts, as at 78, are threadably mounted on the post 72. The other end of the spring is disposed over a post similar to the post 72 carried by the underside of the flipper 66 and extending inwardly of the screw axis. It will be apparent that by outward threading of the nuts 78 the compression of the spring 70 may be adjusted to provide a predetermined force on the underside of the flipper urging the same away from the screw shank and toward the inner diameter of the sleeve 38.

The force exerted by the spring 70 on the flipper 66 will determine the back pressure imparted on the solids discharging from the extractor. This back pressure must be sufficient to prevent blowout of the plug at the outer end of the screw so as to maintain the desired pressure within the extractor. In this connection the flipper 66 should fit closely between the last and next to last turn of the rib 60. In order to avoid loss of pressure in the vessel feeding the extractor, during initial startup of the apparatus and until such time as the plug of solids is obtained as aforedescribed, it may be desirable to provide sealing means on the edges of the flipper to provide an effective pressure seal.

In the use of the extractor to remove liquid from wood pulp, it is preferred that the amount of liquid in the solid material discharged from the extractor be no less than about 25 percent by weight of the material. The pulp is compressed only very slightly between the inlet end of the screw and the lesser diameter end of the frusto-conical portion of the screw shank. In this connection the cross-sectional area of the helical passage defined in part by the screw, as well as the pitch of the screw remains substantially constant from the inlet end of the screw to the inlet end of the screen 42. At least about 3 turns of the screw rib are disposed in the cylinder 26 to assure proper agitation of the solids in suspension to prevent clogging of the inlet. Thus, it will be seen that little, if any, compression of the pulp occurs below the lesser diameter end of the portion 56 of the screw shank which corresponds generally to the liquid level in the extractor. Over the screw shank portion 56, the cross-sectional area of the helical passage is gradually reduced both by the increasing outer diameter of the shank and a decrease in pitch of the rib 60. The cross-sectional area of the helical passage at the inlet and outlet ends, respectively, of the shank portion 56 should be in a ratio of about 3:1. In the portion of the helical passage contained within the cylinder 38, the cross-sectional area reduction of the passage should be about 1.25:1 from the inner to the outer end of the cylinder by reason of a further decrease in pitch of the rib. It will thus be seen that substantially all of the compression of the pulp occurs over the shank portion 56 above the liquid level. After the pulp passes from the extractor it may drop into a collection bin or tank, preferably filled with fresh water and provided with agitating means to break up the pulp so that it may more readily absorb the fresh water for further rinsing operations. The press may be operated relatively fast, on the order of at least 125 r.p.m. The pulp is gradually compressed in the extractor to remove a sufficient quantity of liquid therefrom while at the same time not compacted sufficiently to form paper. Further, the structure of the extractor assures that neither the inlet 32 nor the screen 42 will become clogged with pulp thus interfering with the continuous flow of liquid from the inlet 32 through the outlet 41. Thus, it can be seen that a screw press of the present invention is readily adapted to a continuous digesting operation.

While the invention thus far has been described primarily in connection with the washing of pulp in a continuous digesting operation, the invention is not limited to such use. For example, an extractor of this invention could readily be used for the removal of liquid from garbage, thus reducing the volume required for storage of garbage in those communities requiring storage and refrigeration until collection. Even if the weight and/or volume of the garbage were reduced to 25 or 50 percent of the original weight or volume there would be a sizable economy realized. Where the extractor is used for such a purpose it would not be necessary to provide a sealing plug at the outer end of the extractor; rather the flipper 66 would merely be used, if at all, to maintain sufficient back pressure on the solid material being dis-

charged to assure sufficient extraction of liquid therefrom. Further, the valve **62** in the outlet conduit **41** would not be required as it would not be necessary to maintain pressure within the system. However the valve could be used to assist in maintaining the liquid level **64** at the height described previously in order to assure that there will be no clogging of the screen **42**. The imperforate cylindrical member **26** would offer advantages in this last connection, in that it would assure that the garbage at the inlet end of the screw would be maintained in suspension in liquid so as not to be compacted and clog the inlet **32**.

While only certain preferred embodiments of this invention have been shown and described by way of illustration, many modifications will occur to those skilled in the art and it is, therefore, desired that it be understood that it is intended in the appended claims to cover all such modifications as fall within the true spirit and scope of this invention.

What is claimed as new and what it is desired to secure by Letters Patent of the United States is:

1. In a system for extracting liquid from solids containing liquid, a screw press comprising a rotatable screw having its axis extending at a substantial angle to the horizontal, foraminate means surrounding said screw intermediate its ends and disposed closely adjacent to the outer diameter of said screw, means providing an imperforate housing having a first portion surrounding said foraminate means in outwardly spaced relation and a second portion surrounding the lower end of said screw in closely adjacent relation, means providing an inlet in said housing below said foraminate means, means providing a liquid outlet in said housing intermediate the ends of said foraminate means, and means for maintaining the liquid level in the extractor above said liquid outlet, said screw cooperating with said second portion of the housing below said foraminate means and with said foraminate means to provide a helical passage extending about said screw axis, the cross-sectional area of said passage being less adjacent the upper end of said foraminate means than adjacent the lower end thereof with a substantial majority of the reduction in said cross-sectional area occurring above the liquid outlet of the extractor, said second portion extending over at least about three turns of said screw to assure that during operation of the press the solids in said second portion will be suspended in liquid to preclude clogging of said outlet.

2. In a screw press for extracting liquid from a solid containing liquid, a rotatable screw having its axis extending at a substantial angle to the horizontal, means providing a housing surrounding the said screw and extending longitudinally thereof, foraminate means surrounding the screw intermediate its ends and disposed closely adjacent the outer diameter of said screw, means providing an inlet for said housing adjacent its lower end, means providing a liquid outlet in said housing intermediate the ends of said foraminate means, means to maintain the liquid level within said housing substantially above said liquid outlet, said screw in part defining a helical passage extending from the lower end of the screw to the upper end thereof, the cross-sectional area of said passage being lesser at the upper end of said foraminate means than at the lower end thereof with a substantial majority of the reduction in cross-sectional area of said passage taking place above said liquid level, and means for providing a fluid pressure seal to prevent the escape of fluid pressure from within said housing through the upper end of said helical passage comprising means adjacent the upper end of said screw for impeding the flow of material out of said passage.

3. In a screw press for extracting liquid from a solid containing liquid, a rotatable screw having its axis extending at a substantial angle to the horizontal, means providing a housing for said screw comprising a first imperforate cylindrical member disposed coaxially over the lower end of said screw closely adjacent to the outer diameter thereof and extending over a plurality of turns of said screw, means closing the lower end of said cylindrical member, a second imperforate cylindrical member extending coaxially of the screw from the upper end of said first cylindrical member in radially outwardly spaced and fluid tight relation thereto, foraminate means disposed within said second cylindrical member in radially inwardly spaced relation and closely adjacent the outer diameter of said screw, means providing an inlet in said first cylindrical member intermediate the ends thereof, means providing a liquid outlet in said second cylindrical member intermediate the ends thereof, and means for maintaining the liquid level in said housing above said liquid outlet, said screw forming in cooperation with said first cylindrical member and said foraminate means a helical passage extending about said screw and longitudinally of its axis, the cross-sectional area of said passage being lesser adjacent the upper end of said foraminate means than adjacent the lower end thereof with a greater amount of reduction in cross-sectional area of said passage occurring above said liquid level.

4. A screw press for extracting liquid from a solid containing liquid comprising a rotatable screw having its axis extending at a substantial angle to the horizontal and including a shank having a cylindrical first portion extending from the lower end of the screw and terminating in a reversely tapered frusto-conical second portion which in turn terminates in a cylindrical third portion of the same diameter as the greater diameter end of said second portions of the shank, a helical rib disposed about said shank and extending longitudinally thereof, said rib having a substantial constant outer diameter, the pitch of said rib being substantially constant from the lower end thereof to a point adjacent the lesser diameter end of said second portion of the shank and then gradually decreasing over said second portion to the greater diameter end thereof to a predetermined amount, the pitch of said rib further decreasing from adjacent the greater diameter end of said second portion of the shank to the upper end of said screw but to a substantially lesser degree than the decrease in pitch over said second portion, an imperforate first cylindrical member disposed coaxially over the lower end of said screw and extending over a plurality of turns of said rib from the lower end of the screw, said first member terminating in an imperforate second cylindrical member disposed coaxially about said screw in radially outwardly spaced relation, said second member terminating in an imperforate third cylindrical member disposed coaxially about and closely adjacent the outer diameter of said rib and extending at least to the upper end of said screw, cylindrical foraminate means disposed coaxially within said second member in radially inwardly spaced relation and closely adjacent the outer diameter of said screw, the inner diameter of said foraminate means being substantially equal to the inner diameters of said first and third members, valve means connected to said liquid outlet to maintain the pressure drop across said extractor to a predetermined amount, means including said valve means to maintain the liquid level in said extractor substantially above said liquid outlet and adjacent the lesser diameter end of said second portion of the shank, and means to prevent any substantial leakage of fluid pressure externally of the extractor through the upper end of said third member comprising means adjacent the upper end of said third member tending to impede the flow of material therefrom thereby to provide a plug of material over a substantial length of said third member with the plug further tending to provide a bearing for the upper end portion of said screw.

5. A screw press as described in claim **4** wherein said last mentioned means comprises a flipper disposed between the last and next to last turn of said rib, said

flipper having a leading edge remote from the outer end of said rib which is pivotally supported on said shank for movement of the other end of the flipper toward and away from said shank, and resiliently yieldable means acting on said flipper and tending to move said other end of the same outwardly of the shank toward the inner surface of said third cylindrical member.

6. In a screw press for extracting liquid from wood pulp and the like, a rotatable screw having its axis extending at a substantial angle to the horizontal, an imperforate generally cylindrical housing for the screw having a center portion spaced outwardly from the screw and terminating at its ends in a pair of reduced diameter end portions disposed closely adjacent the outer diameter of the screw, generally cylindrical foraminate means disposed in said outer portion coaxially over the screw in inwardly spaced relation to said center portion and closely adjacent to the outer diameter of the screw, said screw and end portions and foraminate means cooperating to provide a helical passage having a substantially constant cross-sectional area from the lower end thereof to a point between the ends of said foraminate means, said cross-sectional area decreasing between said point to the upper end of said screw sufficiently and in a manner to remove a predetermined amount of liquid from wood pulp while not compacting the pulp sufficiently to form paper, means providing an inlet below said foraminate means, means providing an outlet between said inlet and said point, means for maintaining the liquid level in said housing above said outlet and adjacent said point, means to prevent escape of fluid pressure within said housing through the upper end of said helical passage including means adjacent the upper end of the upper of said end portions tending to obstruct flow of solid material from the upper end of said helical passage to provide a fluid pressure sealing plug of said solid material in said helical passage extending over more than one turn of said passage about said axis, means to maintain a relatively low pressure drop between said inlet and outlet, the cross-sectional area of said passage being reduced in the ratio of about 3:1 between said point and the upper end of said foraminate means and to a substantially lesser amount between the upper ends of said foraminate means and the upper end of the screw, said means to prevent escape of fluid pressure being operable to effect the maintenance of a fluid pressure within the housing of at least about 100 p.s.i.

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